REMARKS

Claims 1-48 are currently pending in the application. By this amendment, claims 1, 15, 16, 42, 46, and 47 are amended for the Examiner's consideration. The above amendments do not add new matter to the application and are fully supported by the original disclosure. For example, support for the amendments is provided in the claims as originally filed, at Figure 5, and at paragraphs 0054, 0061, 0070, 0074, 0080-0082, 0088, 0093, 0095, and 0107-0111 of Applicants' published application (i.e., U.S. Pub. No. 2006/0066841). Reconsideration of the rejected claims in view of the above amendments and the following remarks is respectfully requested.

Allowable Subject Matter

Applicant appreciates the Examiner's indication that claims 30 – 41 are allowed and that claims 16-20 are allowable. By this amendment, claim 16 is re-written in independent form. As such, claims 16-20 should be allowed. Moreover, Applicants respectfully submit that all of the claims are in condition for allowance for the reasons set forth below.

35 U.S.C. §102 Rejection

Claims 1 – 6, 9 – 13, 15, 21 – 26 and 46 – 48 were rejected under 35 U.S.C. §102(e) for being anticipated by U.S. Patent No. 6,653,032 issued to Miwa et al. ("Miwa"). This rejection is respectfully traversed.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). See, MPEP

§2131. Applicants submit that the applied art does not show each and every feature of the claimed invention.

Independent Claim 1

The present invention relates to a method and system for reconstructing aberrated image profiles through simulation. In exemplary embodiments, a method involves constructing a description of the image profile that most easily allows rapid re-calculation of the profile when the lens aberrations are changed. The response surface description of changes due to aberration are also naturally well-aligned with tasks that would require optimization of aberrations, which are adjusted in practice by adjusting various optical elements within the projection lens. More specifically, claim 1 recites:

> 1. A method of calculating estimated image profiles implemented on a tangibly-embodied storage medium resident on one or more computing devices, comprising the steps of:
>
> providing imaging configuration characteristic data;
>
> performing simulation calculations for various levels for each aberration component using the imaging configuration characteristic data using a processor of the one or more computing devices;
>
> building response surface functional relations using the processor of the one or more computing devices between variables of lens characteristics and an image profile of interest using the simulation calculations, wherein the response surface functional relations are based on a value of an aberration component;
>
> receiving specified aberration values of a lens; and
>
> calculating an image profile using specified aberration values of a lens in conjunction with the response surface functional relations using the processor of the one or more computing devices.

The Examiner asserts that Miwa discloses the recited "building response surface functional relations using the processor of the one or more computing devices between variables of lens characteristics and an image profile of interest using the simulation calculations" at col. 2,

lines 50-54. Notwithstanding, Applicants submit that Miwa does not disclose the combination of features recited in claim 1 and therefore does not anticipate claim 1. More specifically, as discussed in greater detail below, Miwa does not disclose: (i) *building response surface functional relations using the processor of the one or more computing devices between variables of lens characteristics and an image profile of interest using the simulation calculations, wherein the response surface functional relations are based on a value of an aberration component*; or (ii) *calculating an image profile using specified aberration values of a lens in conjunction with the response surface functional relations*.

At the passage identified by the Examiner (i.e., col. 2, lines 50-54), Miwa describes background prior art (i.e., Aida et al.) that produces response surface functions of CD values and calculates exposure energy and focus offset from these response surface functions. More specifically, Miwa states:

> As a way to solve this problem, Aida et al. (Electronic Information Society, Introduction into Response surface functions For Statistical Design of Optical Lithography Processes, 1996), for example, have proposed a method for producing response surface functions of CD values, using exposure energy, focus offset and the illumination parameters of the optical projection system (numerical aperture NA and illumination coherency σ) as variables, and calculating exposure energy and focus offset from these response surface functions.

(Miwa, col. 2, lines 47-56).

However, Miwa does not disclose that the response surface functions *are based on a value of an aberration component*, as recited in claim 1. Instead, the response surface functions are functions of CD (critical dimension) values. The CD values are not values of aberration components, and there is no mention in Miwa that the response surface functions have anything to do with a value of an aberration component. Therefore, Miwa does not disclose *building*

response surface functional relations ... wherein the response surface functional relations are based on a value of an aberration component, as recited in claim 1, and cannot reasonably be said to anticipate the claimed invention.

Miwa also fails to disclose *calculating an image profile using specified aberration values of a lens in conjunction with the response surface functional relations*, as further recited in claim 1. Miwa, in describing the prior art Aida, discloses calculating exposure energy and focus offset from the above-noted response surface functions. However, Miwa does not disclose calculating the exposure energy and focus offset using aberration values in conjunction with the response surface functions. To the contrary, there is no mention in Miwa that Aida's response surface functions are used in conjunction with aberration values in order to determine the exposure energy and focus offset.

Applicants acknowledge that Miwa mentions aberrations in other portions of the document. For example, in Miwa's invention, a database stores aberration information (col. 4, lines 1-4). Miwa's invention calculates margins of exposure energy and focus with an optical development simulator using the aberration information (col. 4, lines 34-38).

However, Miwa does not disclose that the stored aberration information is used with the prior art Aida response surface functions. Instead, Miwa only discloses using the stored aberration information with an optical development simulator, which is not disclosed as the response surface functions of Aida. That is, Miwa separately discloses (i) calculating the exposure energy and focus offset, (ii) aberration values, and (iii) response surface functions; however, Miwa does not disclose that the calculating the exposure energy and focus offset is performed by using aberration values in conjunction with the response surface functions.

Moreover, it is improper for the Examiner to pick-and-choose unrelated aspects of the Miwa disclosure in an attempt to reject Applicants' claims under §102. It is well settled that an anticipation rejection requires more than just a mere disclosure of all elements in a claim:

> To anticipate, the reference "must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements 'arranged as in the claim.'" *Sanofi-Synthelabo v. Apotex, Inc.*, 550 F.3d 1075 (Fed. Cir. 2008), (citing *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008) (quoting *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983)); see also, e.g., *In re Arkley*, 455 F.2d 586, 587 (CCPA 1972) ("[The] reference must clearly and unequivocally disclose the claimed [invention] or direct those skilled in the art to the [invention] without any need for picking, choosing, and combining various disclosures not directly related to each other by the teachings of the cited reference" (emphasis in original)).

In this case, the Examiner is improperly picking and choosing unrelated features from Miwa's background (i.e., Aida's response surface functions) and Miwa's invention (i.e., aberration information). Miwa does not disclose that the response surface functions described in the background are based on aberration values, and Miwa does not disclose that the image profile is calculated using the response surface functions in conjunction with the aberration values. Therefore, Miwa does not disclose or suggest *calculating an image profile using specified aberration values of a lens in conjunction with the response surface functional relations*, as further recited in claim 1. Therefore, Miwa does not disclose all of the features of claim 1 and does not anticipate claim 1.

Independent Claims 46 and 47

Independent claim 46 recites:

> 46. A system for providing optimal image profiles through the optimization of specified aberration components, according to their associated impact upon image profile, comprising:

> means for performing simulation calculations for various levels for each aberration component using image configuration characteristic data;
>
> means for building response surface functional relations between variables of lens characteristics using the simulation calculations, wherein the response surface functional relations are based on a value of an aberration component;
>
> means for calculating image profile estimates for specified aberration values of a lens by evaluating the specified aberration values in relation to the response surface functional relations; and
>
> means for applying the aberrated image profile estimates in an optimization calculation method which judges image profile information against defined criteria as part of a lens adjustment optimization calculation.

Also, independent claim 47 recites:

> 47. A tangibly-embodied machine readable medium containing code operable to adjust a lens, comprising at least one module for:
>
> performing simulation calculations for various levels for each aberration component using image configuration characteristic data;
>
> building response surface functional relations between variables of lens characteristics using the simulation calculations, wherein the response surface functional relations are based on a value of an aberration component; and
>
> calculating image profile estimates for specified aberration values of a lens by evaluating the specified aberration values in relation to the response surface functional relations.

Applicants submit that Miwa does not disclose the combinations of features recited in claims 46 and 47. More specifically, Miwa does not disclose *the response surface functional relations are based on a value of an aberration component*. As discussed *supra* with respect to claim 1, Miwa discloses response surface functions when describing the Aida prior art (see, e.g., Miwa col. 2). However, Miwa does not disclose that these response surface functions are associated with an aberration component. To the contrary, Miwa is silent with respect to aberration components when describing Aida's response surface functions. Therefore, Miwa

does not disclose *the response surface functional relations are based on a value of an aberration component*, as recited in claims 46 and 47.

Furthermore, Miwa does not disclose *means for calculating image profile estimates for specified aberration values of a lens by evaluating the specified aberration values in relation to the response surface functional relations*, as recited in claim 46, or *calculating image profile estimates for specified aberration values of a lens by evaluating the specified aberration values in relation to the response surface functional relations*, as recited in claim 47. Miwa discloses calculating exposure energy and focus offset using the response surface functions. Miwa also separately discloses aberration values. However, Miwa does not disclose evaluating aberration values in relation to the response surface functions. Therefore, Miwa cannot reasonably be construed as disclosing calculating exposure energy and focus offset evaluating aberration values in relation to the response surface functions. As such, Miwa does not disclose *means for calculating image profile estimates for specified aberration values of a lens by evaluating the specified aberration values in relation to the response surface functional relations*, as recited in claim 46, or *calculating image profile estimates for specified aberration values of a lens by evaluating the specified aberration values in relation to the response surface functional relations*, as recited in claim 47.

Dependent Claims 2 – 6, 9 – 13, 15, 21 – 26 and 48

For the above-noted reasons, Applicants submit that Miwa does not disclose all of the features of independent claims 1, 46, and 47. Claims 2 – 6, 9 – 13, 15, 21 – 26 and 48 depend from independent claims 1 and 47, respectively, and are distinguishable from Miwa for at least the same reasons as the respective base claims. Moreover, Miwa does not disclose all of the features of these dependent claims.

For example, claim 15 depends from claim 1 and additionally recites *the performing simulation calculations for various levels for each aberration component comprises performing a full simulation calculation, and the calculating the image profile is performed without performing a full simulation calculation each and every time new specified aberration values are provided and presented for calculation of a new image profile*. Applicants submit that Miwa does not disclose these features.

In exemplary embodiments of the claimed invention, an image profile for a specified set of aberration values is calculated using response surfaces instead of performing a full simulation each time a new set of aberration values is received. More specifically, in embodiments, a setup phase involves performing full image simulations in order to create the response surfaces. However, this computationally intensive setup phase is only performed once, i.e., to create the response surfaces. After the setup phase, an image profile for a lens may be calculated using a specified set of aberration values and the response surfaces, without having to perform the computationally intensive full image simulation again. In this manner, implementations of the invention reduce the time and computation required in evaluating a new lens adjustment. This is described, for example, in paragraphs 0080-0082, 0095, and 0107-0111 of Applicants' published application (i.e., U.S. Pub. No. 2006/0066841).

Miwa, on the other hand, does not disclose calculating an image profile without performing a full simulation calculation each and every time new specified aberration values are provided and presented for calculation of a new image profile. Instead, in the description of Miwa's inventive system and method, Miwa does not specify the manner in which the image simulations are calculated. That is, in Miwa's invention, only the inputs (i.e., data values representing a given exposure tool's current state of performance) and the outputs (i.e., the

process window) are specified; however, the calculation method for getting from the inputs to the outputs is not disclosed. Therefore, Miwa does not disclose recites *the performing simulation calculations for various levels for each aberration component comprises performing a full simulation calculation, and the calculating the image profile is performed without performing a full simulation calculation each and every time new specified aberration values are provided and presented for calculation of a new image profile*, as recited in claim 15.

Accordingly, Applicant requests the §102 rejection of claims 1 – 6, 9 – 13, 15, 21 – 26 and 46 – 48 be withdrawn.

35 U.S.C. § 103 Rejections

Claims 7, 8, 14, 28 and 29[1] are rejected under 35 U.S.C. §103(a) as being unpatentable over Miwa in view of US Patent No. 6,493,063 issued to Seltmann et al. ("Seltmann"). Claims 42 – 45 are rejected under 35 U.S.C. §103(a) as being unpatentable over Miwa in view of US Patent No. 5,528,118 issued to Lee et al. ("Lee"). These rejections are respectfully traversed.

To establish a *prima facie* case of obviousness, all claim limitations must be taught or suggested by the prior art. *See, In re Royka*, 490 F.2d 981, 985, 180 USPQ 580, 583 (CCPA 1974); *see also, In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).[2] If the prior art reference(s) do not teach or suggest all of the claim limitations, Office personnel must explain why the differences between the prior art and the claimed invention would have been obvious to

[1] It is noted that claim 27 also appears to be rejected under §103 in view of Miwa and Seltmann at pages 13-14 of the Office Action. For purposes of this response, applicants assume that claims 7, 8, 14, and 27-29 are rejected under §103 in view of Miwa and Seltmann. Clarification is requested in the next Official Communication.

[2] While the *KSR* court rejected a rigid application of the teaching, suggestion, or motivation ("TSM") test in an obviousness inquiry, the [Supreme] Court acknowledged the importance of identifying "a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does" in an obviousness determination. *Takeda Chemical Industries, Ltd. v. Alphapharm Pty., Ltd.*, 492 F.3d 1350, 1356-1357 (Fed. Cir. 2007) (quoting *KSR International Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1731 (2007)).

one of ordinary skill in the art (MPEP 2141). Applicants submit that no proper combination of the applied art teaches or suggests each and every feature of the claimed invention.

Claims 7, 8, 14, and 27-29 in view of Miwa and Seltmann

Claims 7, 8, 14, and 27-29 depend from independent claim 1 and are distinguishable from the applied art at least for the same reasons as claim 1. Seltmann does not cure the deficiencies of Miwa with respect to claim 1 because Seltmann does not teach or suggest disclose: (i) *building response surface functional relations using the processor of the one or more computing devices between variables of lens characteristics and an image profile of interest using the simulation calculations, wherein the response surface functional relations are based on a value of an aberration component*; or (ii) *calculating an image profile using the specified aberration values in conjunction with the response surface functional relations using the processor of the one or more computing devices*, as recited in claim 1. Nor has the Examiner relied on Seltmann to teach these features. As such, the applied art does not teach the combination of features recited in claim 1, from which claims 7, 8, 14, and 27-29 depend. Therefore, by definition, the applied art does not teach or suggest the combinations of features recited in claims 7, 8, 14, and 27-29, and does not render these claims unpatentable.

Accordingly, Applicant respectfully requests the §103 rejection of claims 7, 8, 14, and 27-29 be withdrawn.

Claims 42-45 in view of Miwa and Lee

Independent claim 42 recites:

> 42. An exposure apparatus, comprising:
> an illumination system that projects radiant energy through a mask pattern on a reticle R that is supported by and scanned using a wafer positioning stage;
> at least one linear motor that positions the wafer positioning stage;

> a system for providing optimal image profiling, including:
> means for providing image configuration characteristic data;
> means for performing simulation calculations for various levels for each aberration component using the image configuration characteristic data;
> means for building response surface functional relations between variables of lens characteristics associated with the image configuration characteristic data using the simulation calculations, wherein the response surface functional relations are based on a value of an aberration component; and
> means for calculating image profile estimates for specified aberration values of a lens by evaluating the specified aberration values in relation to the response surface functional relations.

Applicants submit that no proper combination of Miwa and Lee teaches the combination of features recited in independent claim 42. More specifically, neither Miwa nor Lee teaches: (i) *means for building response surface functional relations between variables of lens characteristics associated with the image configuration characteristic data using the simulation calculations, wherein the response surface functional relations are based on a value of an aberration component*; or (ii) *means for calculating image profile estimates for specified aberration values of a lens by evaluating the specified aberration values in relation to the response surface functional relations*, as recited in claim 42.

As discussed *supra* with respect to claims 1, 46, and 47, Miwa does not disclose or suggest *the response surface functional relations are based on a value of an aberration component*. Moreover, as discussed above with respect to claims 46 and 47, Miwa does not disclose or suggest *calculating image profile estimates for specified aberration values of a lens by evaluating the specified aberration values in relation to the response surface functional relations*. Therefore, Miwa does not disclose all of the features of claim 42.

Lee does not cure the deficiencies of Miwa with respect to claim 42 because Lee does not teach or suggest disclose: (i) *means for building response surface functional relations between variables of lens characteristics associated with the image configuration characteristic data using the simulation calculations, wherein the response surface functional relations are based on a value of an aberration component*; or (ii) *means for calculating image profile estimates for specified aberration values of a lens by evaluating the specified aberration values in relation to the response surface functional relations.* Nor has the Examiner relied on Lee to teach these features. Instead, the Examiner relied on Lee for a teaching of a linear motor.

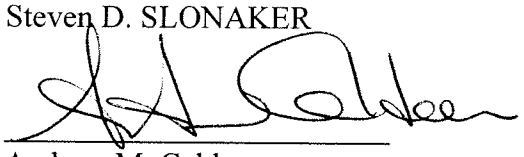
As such, the applied art does not teach the combination of features recited in independent claim 42, and does not render claim 42 unpatentable. Claims 43-45 depend from independent claim 42 and are distinguishable from the applied art at least for the same reasons as claim 42.

Accordingly, Applicant respectfully requests the §103 rejection of claims 43-45 be withdrawn.

CONCLUSION

In view of the foregoing amendments and remarks, Applicants submit that all of the claims are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue. Further, any amendments to the claims which have been made in this response and which have not been specifically noted to overcome a rejection based upon the prior art, should be considered to have been made for a purpose unrelated to patentability, and no estoppel should be deemed to attach thereto. The Examiner is invited to contact the undersigned at the telephone number listed below, if needed. Applicants hereby make a written conditional petition for extension of time, if required. Please charge any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 50-2478.

Respectfully submitted,
Steven D. SLONAKER



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